

INTERPLANETARY SMALL MISSION STUDIES

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Small missions can play a large role in future robotic space exploration. While these missions cannot accomplish the vast scope of science objectives achieved by large missions such as Mars Sample Return or Cassini, they offer opportunities to explore smaller, but pertinent, science goals for significantly reduced total mission cost.

As launch vehicle providers (both foreign and domestic) explore options for increased numbers of secondary launch opportunities, the possibilities for small missions increase. The ability to launch small interplanetary missions for a fraction of the cost is a primary benefit of secondary missions. Secondary missions can also be used to divide up larger missions into a number of smaller missions. This allows project risk to be spread over a wider array of missions, as losing one spacecraft out of several does not constitute a total project loss. Instruments that are flown together are not always optimized for the same orbit. Therefore, splitting science instruments between spacecraft also allows for more precise scientific targeting. These and other benefits provide valuable options for mission planners.

The Jet Propulsion Laboratory's Advanced Projects Design Team (Team X) has conducted several mission studies to explore the feasibility of scientifically significant small interplanetary missions. These mission studies encompassed various targets (Mars, Earth's Moon, Venus, the Sun) using several scientific payloads (radar, imagers, radiometers, etc.). These missions can also perform other functions such as probe/balloon delivery or communications relay for landed missions. The studies considered a range of launch vehicle options (secondary launches using Delta, Atlas, and Ariane platforms). This paper will highlight the results from these studies, and discuss how the concurrent engineering environment of Team X lends itself to rapid systems-level trade studies for pre-phase A concept investigations. The goal is to present several viable options for small "secondary payload class" missions, explain how these missions differ from traditional primary missions, and show specific metrics which demonstrate the attractiveness of the small mission platform.